台北縣重和地區土石流發生機制之工程地質特性探討

The Engineering Geological Characteristics of the Triggered Mechanism of Debris Flow in Chonho Area of Taipei County

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摘要

本研究主要是利用現場地質及地貌的調查工作、不同年度航照判釋的比對、地質材料試驗以及溝谷兩側坡體之穩定性分析等方式來對本區土石流的工程地質特性作一深入的探討。本研究地點爲民國 89 年 11 月象神颱風侵襲台北縣金山鄉重和地區所造成的土石流災害。

從現場調查結果顯示，本研究區源頭處爲一大型崩塌地，其崖壁之上段爲兩輝安山岩質的熔岩流，與下段的凝灰角礫岩成一不整合接觸，熔岩流崖壁上之二組不連續面形成潛在性楔形破壞模狀。中游爲安山岩質之凝灰角礫岩所組成，中游的下半段出露了凝灰角礫岩與中新世桂竹林層泥質砂岩的不整合面，其鄰近岩坡風化較嚴重而岩質相當破碎。從歷年航照判釋比對可發現，本研究區在過去二十年來地貌變化並不大，即溝谷間切蝕及堆積情形並不明顯。民國 89 年象神颱風在本區造成土石流後，則對溝谷沿線產生整體地形、地貌的改變。除了主流溝谷沿線有 5 個以上之小型崩塌地外，其上游源頭大型崩塌地所產生的土石方量達 61000 m3，佔本區土石方量的 50%。

從地質材料試驗結果顯示，溝谷堆積材料粒徑大於 2mm 的顆粒約佔 75%，主要是以安山岩塊爲主。堆積材料在乾燥狀態與飽和狀態下的摩擦角分別爲 37°與 29°。位於源頭崩塌崖壁上段之安山岩熔岩流，在乾燥時的摩擦角介於 34°至 49°之間，飽和時介於 26°至 34°。中游凝灰角礫岩強度介於 75 至 130Mpa 之間；泥質砂岩乾燥時的摩擦角介於 30°至 36°之間，浸水時則完全崩壞。本研究區中溝谷沿線之坡體有 3 處崩塌地是發生在不整合面周圍 100 公尺範圍內，從坡體穩定性分析結果顯示，分布於此不整合面鄰近的坡體均較他處之坡體爲不穩定。因此在高降雨強度下，本研究區之源頭處產生了大型崩塌，大量之土石與持續不斷的降雨混合，並往下游流動形成土石流，在流動過程中也同時淘蝕溝谷兩側谷壁及河床之地質材料，並繼續往下游流動而造成土石流災害。

關鍵詞：土石流、地貌、地質材料

Abstract

A debris flow occurred in Chonho, Cninshan area of Taipei County during Typhoon Xangsane passed through Taiwan in November 1, 2000. This study focused on the characteristics of debris flow by using various methods, such as in-situ geomorphological investigation, aerial photography, geomaterial testing and slope stability analysis.

The investigated results demonstrated the originated area have a large landslide which provided a large volume of deposited materials and moved toward the downhill. By using the jugement of aerial photographs, it could be comprehended that the geomorpholoical features of the study area have rare changes in past 20 years, but those had some varieties in geomorphology and topography after the typhoon.

The rock discontinuities developed very well on the both sides of valley. The discontinuities and slope surfaces formed various types of failure models, such as plane failure, wedge failure and toppling. The experimental results showed that the friction angles of deposited materials ranged from 29° to 30° in saturated condition and 36° to 39° in general. The outcrops of andesite in saturated condition ranged from 26° to 34° and 34° to 49° in general. The results of stability analysis also showed that the rock slopes and deposited materials were unstable in saturated condition. Therefore, high intensity of precipitation triggered occurrence of the landslides and caused the failure of deposited materials. The geomaterials would mix with water and produce debris flow. The sidewalls of the gully would be cut and eroded during the flowing process and it would add more geomaterials to the debris flow.

Key words: debris flow, geomorphology, geomaterial